TECHNICAL INFORMATION

Low Solids No-clean Flux

JS-3101F

KOKI COMPANY LIMITED

1. Features

- Extremely low residue.
- Equivalent electrical reliability to an RMA type flux and highly moisture resistant, preventing occurrence of current leakage in high humidity environments.
- Suitable for both spray and foam applications.
- Drastically reduces the incidence of solder balling.

2. Specifications

Item		**JS-3101F**	Remark
Specific gravity		0.806	--
Solids content %		3.1	--
Non-volatile component %		7.1	--
Acid value KOHmg/g		19.9	Titration
Halogen content		0	Potentiometric titration
Silver chromate paper test		No discoloration	MIL-F-14256E
Copper plate corrosion test		No evidence of corrosion	60°C × 95%RH × 500Hr
Copper mirror corrosion test		No evidence of breakthrough	IPC-TM-650 2.3.32
Water extract resistivity Ω•cm		$> 4 \times 10^4$	MIL
Solder spread factor %		80	150°C × 60sec. Oxide copper plate
Surface insulation resistance (Ω)	Initial value	$> 1 \times 10^{14}$	100°C × 30min.
	In 60°C/95%RH/96Hr	$> 1 \times 10^{10}$	Measured in thermo hygrostat
	After 60°C/95%RH/96Hr	$> 1 \times 10^{12}$	Out of thermo hygrostat
Voltage applied Insulation resistance (Ω)	Initial value	$> 1 \times 10^{13}$	100°C × 30min.
	In 60°C/95%RH/500Hr	$> 1 \times 10^{10}$	Measured in thermo hygrostat
	After 60°C/95%RH/500Hr	$> 1 \times 10^{12}$	Out of thermo hygrostat
	Electromigration	No evidence of electromigration	--
Wetting (Meniscograph)	Wetting speed Sec.	0.20	Polished copper plate
	H_1 tensile strength D/cm	360	
	H_4 tensile strength D/cm	360	
	Wetting speed Sec.	0.58	Oxidised copper plate 150°C × 60min.
	H_1 tensile strength D/cm	235	
	H_4 tensile strength D/cm	350	
Dryness of flux residue		No attachment of chalk powder	250°C × 5sec

3. Specific gravity

The test shall be carried out to determine the specific gravity of liquid flux by using the float hydrometer standardised in JIS-B-7525.

Take the sample flux into a cleaned and dried glass tube and put it in a constant temperature bath of temperature 20°C.

By floating the specific hydrometer in the flux sample, in the glass tube, measure the specific gravity by reading the upper edge of the meniscus line.

Result

Average	0.806

4. Solids content

The flux shall be sampled approx. 10g and weighted (W1). After heating at 105±2°C for 5 hours, measure the weight again (W2).

$$\text{Solids content (wt\%)} = \frac{\text{Weight after heating (W2; g)}}{\text{Weight before heating (W1;g)}}$$

Repeat the test twice and take an average.

Result

n	1	3.1
	2	3.1
Average (%)		3.1

5. Non-volatile component

The flux shall be sampled approx. 10g and weighted (W1). After heating at 70±2°C for 5 hours, measure the weight again (W2).

$$\text{Solids content (wt\%)} = \frac{\text{Weight after heating(W2; g)}}{\text{Weight before heating (W1;g)}}$$

Repeat the test twice and take an average.

Result

n	1	7.1
	2	7.1
Average (%)		7.1

6. Acid value

This test shall be carried out to determine the acid value in the liquid flux by the manual titration method.

Put 2 grams of flux in the precision of 1/1000g into the beaker of 200ml and pour approx. 50ml of ethyl alcohol/benzene solution (1:2) or isopropyl alcohol, and drop 2~3 drops of phenolhtalein indicator to obtain the sample.

Titrate it with N/2 potassium hydroxsaide/ethyl alcohol standard solution until the end point is obtained, where the sample colour turns to pale red from colourless and remains red for more than 30 seconds.
Conduct the blank test through the entire process and calculate the acid value.

$$\text{Acid value [KOHmg/g]} = \frac{28.5 \times (A\text{-}B) \times F}{S}$$

A : Quantity (ml) of N/2 potassium hydroxide/ethyl alcohol standard solution used this test.
B : Quantity (ml) of N/2 potassium hydroxide/ethyl alcohol standard solution used for blank test.
F : Factor of N/2 potassium hydroxide/ethyl alcohol standard solution.
S : Quantity (g) of sample.

Result

n	1	19.9
	2	19.9
Average (%)		19.9

7. Halogen content (Chloride content)

This test shall be carried out to determine the halogen content in liquid flux by the electric potentiometric titration method.

Put approx. 5gs of flux into the beaker of 200ml and weigh it with the balance in the precision of 1/100gs and pour approx. 100ml of isopropyl alcohol to obtain the sample.

Transfer the sample to the electric potentiometric titration equipment and titrate it with 1/50N silver nitrate standard solution by stirring it with a magnetic stirrer until the end point where electric potential changes largely is determined.

Carry out the blank test through the entire process and calculate the halogen content in the flux from following formula.

Repeat the test twice and take an average.

$$\text{Halogen content (\%)} = \frac{(A\text{-}B) \times 0.000709 \times f}{\text{Mass of flux (g)}} \times 100$$

A : Amount (ml) of 1/50N silver nitrate solution used for the entire test
B : Amount (ml) of 1/50N silver nitrate solution used for the blank test
0.000709 : Amount (g) of halogen corresponds to 1ml of 1/50N silver nitrate solution
f : Factor of 1/50N silver nitrate solution

Result

n	1	0
	2	0
Average (%)		0

8. Silver chromate paper test

Place one drop of test flux on each piece of silver chromate test paper specified in MIL-F-14256E. Allow the droplet to remain on each test piece for a minimum of 15 seconds. After 15 seconds, immediately immerse each test paper in clean isopropyl alcohol to remove residual organic materials.

Allow each test paper to dry for minutes, then examine for colour change.

Result

Result	No evidence of discoloration.

9. Copper plate corrosion

Polish the surface of a copper plate of 0.3×30×30mm in size with metal abrasive, or polish and remove the oxide film with No. 1500 abrasive paper specified in JIS-R-6252 while bathed in organic solvent such as xylene, and after washing out the soil adhering to the surface with alcohol, etc., leave it in the air to dry completely.

Place the sample of approximately 0.1g on the copper plate, melt it by heating for about 5 sec. At 250°C and cool it at room temperature to obtain the test pieces.

Put three test pieces in a thermohygrostat of temperature 60°C×95%RH and humidity 95% for 500 hours and compare them with the reference test piece for the evidence of corrosion.

Result

n	1	No corrosion
	2	No corrosion
	3	No corrosion
Average		No corrosion

10. Copper mirror corrosion

This test method is designed to determine the removal effect the flux has (if any) on the bright copper mirror film which has been vacuum deposited on clear glass.

Apply by vacuum deposition, a film of copper metal on one surface of a cleaned glass sized 1.0×52×76mm specified in JIS-R-3703.

Apply a uniform thickness of approximately 50nm and assure that the finished mirror permits 10±5% transmission of normal incident light of a nominal wave length of 500nm.

Place one drop of test flux on each copper mirror test panel.

Place test panels in a horizontal position in the dust free cabinet at 23±2°C and 50±5% relative humidity for 24 hours.

At the end of 24 hour period, remove the test panels and remove the test flux and control standard fluxes (isopropyl alcohol solution of 35wt% WW rosin) by isopropyl alcohol.

Carefully examine each test panel for possible copper removal or discoloration.

Result

	JS-3101F	WW rosin 35wt% I.P.A. solution
Result	No breakthrough	No breakthrough

11. Resistivity of water extract

Extract the flux in purified water and carry out the test on watersoluble conductive components in the flux measuring the conductivity of the extracted water at 20°C.

Take an amount of 0.1ml flux as the sample into a cleaned and dried 100ml beaker.

Put the sample in the beaker with 50ml of purified water, then cover the beaker with a watch glass, heat and boil it for about 5 minutes, and further continue heating for about 1 minute. Cool the beaker for about 10 seconds at room temperature, put it in a water bath of about 20°C to obtain the test solution, and immediately measure the resistivity of this water solution with a conductivity meter.

The cell of 0.1 cell constant shall be used.

The purified water to use shall have more than 5×10^6 Ω• cm of specific resistance.

The test shall be made 3 times and take the mean value.

Result

n	1	4.5×10^4
	2	4.6×10^4
	3	4.6×10^4
Average (Ω• cm)		4.6×10^4

*Control standard (without flux) : 6×10^6 Ω • cm

12. Solder spread factor

Solder ring : Wind one turn in a ring form solder wire H60A-W1.6 specified in JIS-Z-3282 around a bar with a diameter of 3.2mm to obtain the sample.

Test plate : Use as test plate a phosphor deoxidized copper plate specified in JIS-H-3100, 0.3×50×50mm in size polished by #1500 abrasive paper and washed by alcohol, subject it to oxidizing treatment in electric furnace maintained at about 150°C for 1 hour.

Test method : Place the test piece on the test plate and heat it at 250±5°C. Melt it for about 30 sec. After reaching the said temperature, spread the solder over the plate.

After cooling it at ordinary temperature, remove the residual flux with alcohol, and measure the height of solder and calculate the rate of spread from the following formula :

$$S = \frac{D - H}{D} \times 100$$

S : Rate of solder spreading ..... (%)
H : Height of spread solder ..... (mm)
D : Diameter when the solder used is assumed to be as sphere..... (mm)

$D = 1.2407V^{1/3}$

V : Mass / specific gravity

Result

n	1	84.3
	2	85.1
	3	85.7
	4	86.1
	5	86.3
Average (%)		85.7

13. Insulation resistance

As a test piece, use the comb type electrode of the glass fibre based copper clad, epoxy resin GE-3 and GE-4, both specified in JIS-C-6480. After cleaning with alcohol and thoroughly drying the surface, uniformly apply a specific quantity (JIS type II = 0.05ml) of flux onto the electrode and dry it at about 100°C for 30min. Solder a lead wire onto each terminal to obtain the test piece.

Prepare three pieces of the above test piece and measure the insulation resistance (initial value = DRY) under the above specified condition.

Put all the test pieces in a thermo hygrostat and connect each lead wire with the terminals outside of the thermo hygrostat.

Raise the temperature to a specific temperature first, then increase the humidity up to a specific humidity.

After a specific time,

(1) Measure the insulation resistance keeping the test pieces in the thermohygrostat

(2) Take the test pieces out of the thermohygrostat, and measure the insulation resistance under the normal temperature and humidity.

Voltage to apply shall be DC100V.

Measurement shall be conducted at 4 points between each terminal pair per test piece and be expressed as a mean value.

* Test conditions : 60°C×95%RH×500 hours

Result

		DRY=100°C×30min.	In thermo hygrostat	Out of thermo hygrostat
n	1	3.3×10^{14}	5.3×10^{11}	6.1×10^{12}
	2	4.2×10^{14}	2.6×10^{11}	4.1×10^{12}
	3	5.2×10^{14}	3.2×10^{11}	4.2×10^{12}
Average (Ω)		4.2×10^{14}	3.5×10^{11}	4.7×10^{12}

14. Voltage applied insulation resistance

As a test piece, use the comb type electrode of the glass fibre based copper clad, epoxy resin GE-3 and GE-4, both specified in JIS-C-6480. After cleaning with alcohol and thoroughly drying the surface, uniformly apply a specific quantity (JIS type II=0.05ml) of flux onto the electrode and dry it at about 100°C for 30min. Solder a lead wire onto each terminal to obtain the test piece.

Prepare three pieces of the above test piece and measure the insulation resistance (initial value = DRY) under the above specified condition.

Put all the test pieces in a thermo hygrostat and connect each lead wire with the terminals outside of the thermo hygrostat.

Raise the temperature to a specific temperature first, then increase the humidity up to a specific humidity, and apply DC100V.

After a specific time,

(1) Measure the insulation resistance keeping the test pieces in the thermo hygrostat.
(2) Take the test pieces out of the thermo hygrostat, and measure the insulation resistance under the normal temperature and humidity.

Voltage to apply shall be DC100V for the measurement.

Measurement shall be conducted at 4 points between each terminal pair per test piece and be expressed as a mean value.

* Test conditions : 60°C×95%RH×1000 hours

Result

Sample		DRY=100°C×30min.	In thermo hygrostat	Out of thermo hygrostat
n	1	3.2×10^{14}	1.1×10^{11}	4.1×10^{12}
	2	5.0×10^{14}	3.2×10^{11}	5.4×10^{12}
	3	4.3×10^{14}	3.8×10^{11}	4.7×10^{12}
Average (Ω)		4.2×10^{14}	2.4×10^{11}	4.7×10^{12}

* No evidence of electromigration nor corrosion.

15. Wetting (Meniscograph)

Test plate : Use as test plate a phosphor deoxidized copper plate specified in JIS-H-3100, 0.2×7×30mm in size polished by #1500 abrasive paper and washed by alcohol, subject it to oxidizing treatment in electric furnace maintained at about 150°C for 1 hour.

Condition : Solder temperature - 250 ± 2°C
Dipping depth - 2mm
Dipping speed - 25mm/min.
Solder quality - H-63A

Result

Item		Samples					
		Polished copper plate			Oxidized copper plate		
		Wetting speed (sec.)	Tensile strength H_1 dyne/cm	Tensile strength H_4 Dyne/cm	Wetting speed (sec.)	Tensile strength H_1 dyne/cm	Tensile strength H_4 dyne/cm
n	1	0.19	355	357	0.55	221	350
	2	0.19	362	362	0.58	235	351
	3	0.21	362	362	0.58	238	355
	4	0.21	358	359	0.60	239	342
	5	0.22	361	362	0.60	244	351
Average		0.20	360	360	0.58	235	350

16. Dryness

After cleaning the surface of copper plate of 0.3×30×30mm with alcohol, etc. and drying, put 0.5g of the sample on the copper plate and melt it in about 5 sec. at a temperature of 250±5°C.

After leaving the test piece for 30 minutes at room temperature, sprinkle some white chalk powder on the surface of the remaining flux and check if the chalk powder can be removed by soft brushing.

Result

n	1	No attachment of chalk powder
	2	No attachment of chalk powder
	3	No attachment of chalk powder

17. Recommended soldering condition

- Conveyor speed : 1.0 - 1.8m/min
- Conveyor angle : 3 - 6 degrees
- Pre-heat temp. : 100 - 110°C at soldering side
- Solder temp. : 240 - 260°C
- Dip time. : 2 - 5 sec (total time of first and 2nd wave)

18. Shelf life

- 3 months after opening.
- 1 year without opening

19. Package

- 10 litre / poly can
- 20 litre / poly can